

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Gregory L. Schaffer

Reissue Application No.:

Filed:

For: Dual Interleaved DC to DC
Switching Circuits
Realized in an Integrated
Circuit

Reissue of: USP 5,870,296

Issued: February 9, 1999

Examiner:

Art Group:

AMENDMENT UNDER 37 C.F.R. § 1.173(b)

BOX REISSUE

Assistant Commissioner for Patents
Washington, DC 20231-9998

Sir:

In accordance with 37 C.F.R. § 1.173(b), Applicant respectfully submits that the proposed amendments be incorporated into the above-identified Reissue application prepared in compliance with 37 C.F.R. § 1.173(a) and enclosed herewith. The proposed amendments are set forth below:

- 1 22. A DC to DC switching circuit for controlling power
2 switching devices in a DC to DC converter having a plurality

3 of interleaved converter circuits operating into a common
4 load, comprising:

5 a plurality of pulse width modulators each controlling
6 power switching devices of one of the plurality of
7 interleaved converter circuits;

8 a feedback circuit responsive to a voltage across the
9 common load;

10 control circuits for controlling the plurality of pulse
11 width modulators responsive to the feedback circuit and a
12 commanded output voltage, and for adjusting a nominal duty
13 cycle of the plurality of interleaved converter circuits;

14 the plurality of pulse width modulators and the control
15 circuits being in a single integrated circuit.

1 23. The DC to DC switching circuit of claim 22 further
2 comprising a current sense circuit for balancing current in
3 the plurality of interleaved converter circuits.

1 24. The DC to DC switching circuit of claim 22 further
2 comprised of an integrator having an output responsive to
3 the integral of an error signal, the error signal being
4 responsive to the voltage across the common load and a
5 desired voltage, the control circuits also being responsive
6 to the output of integrator.

1 25. The DC to DC switching circuit of claim 24 wherein
2 a time constant of the integrator is adjustable by the

3 selection of at least one component external to the
4 integrated circuit.

1 26. The DC to DC switching circuit of claim 24 further
2 comprised of a differentiator having an output responsive to
3 the rate of change of the voltage across the common load,
4 the control circuits also being responsive to the output of
5 differentiator.

1 27. The DC to DC switching circuit of claim 26 wherein
2 the time constant of the differentiator is adjustable by the
3 selection of at least one component external to the
4 integrated circuit.

1 28. The DC to DC switching circuit of claim 22 wherein
2 the control circuits are also responsive to rapid decreases
3 in the voltage across the common load to turn on the
4 plurality of converter circuits independent of the phase of
5 the plurality of pulse width modulators.

1 29. The DC to DC switching circuit of claim 28 wherein
2 the control circuits are also responsive to rapid increases
3 in the voltage across the common load to turn off the
4 plurality of converter circuits independent of the phase of
5 the plurality of pulse width modulators.

1 30. The DC to DC switching circuit of claim 22,
2 wherein the plurality of pulse width modulators consist of a
3 pair of pulse width modulators.

1 31. The DC to DC switching circuit of claim 22 wherein
2 the feedback circuit is in the single integrated circuit.

1 32. A DC to DC switching circuit for controlling power
2 switching devices in a DC to DC converter having a plurality
3 of interleaved converter circuits operating into a common
4 load, comprising:

5 a plurality of pulse width modulators each controlling
6 power switching devices of one of the plurality of
7 interleaved converter circuits;

8 a feedback circuit responsive to a voltage across the
9 common load;

10 control circuits being responsive to the feedback
11 circuit and a commanded output voltage to control a nominal
12 duty cycle of the plurality of converter circuits, the
13 control circuits also adjusting a relative duty of the
14 plurality of converter circuits;

15 the plurality of pulse width modulators and the control
16 circuits being in a single integrated circuit.

1 33. The DC to DC switching circuit of claim 32 further
2 comprising:

3 current sense circuits, the control circuits being
4 responsive to the current sense circuits to tend to minimize
5 a difference of current between the plurality of interleaved
6 converter circuits.

1 34. The DC to DC switching circuit of claim 33 wherein
2 the control circuits control the plurality of pulse width
3 modulators.

1 35. The DC to DC switching circuit of claim 32 further
2 comprising: an integrator having an output responsive to
3 the integral of an error signal, the error signal being
4 responsive to the voltage across the common load and a
5 desired voltage.

1 36. The DC to DC switching circuit of claim 35,
2 wherein the control circuits is also responsive to the
3 output of integrator.

1 37. The DC to DC switching circuit of claim 35 wherein
2 a time constant of the integrator is adjustable by the
3 selection of at least one component external to the
4 integrated circuit.

1 38. The DC to DC switching circuit of claim 35 further
2 comprising a differentiator having an output responsive to a
3 rate of change of the voltage across the common load, the

1 44. The DC to DC switching circuit of claim 32 wherein
2 the feedback circuit is in the single integrated circuit.

1 45. A circuit in a DC to DC converter having a
2 plurality of interleaved converter circuits operating into a
3 common load, comprising:

4 a plurality of pulse width modulators each controlling
5 power switching devices of one of the plurality of
6 interleaved converter circuits;

7 control circuits for adjusting a nominal duty cycle of
8 the plurality of interleaved converter circuits;

9 the plurality of pulse width modulators and the control
10 circuits being in a single integrated circuit.

11 46. A DC to DC switching circuit for controlling power
12 switching devices in a DC to DC converter having first and second
13 interleaved converter circuits operating into a common load,
14 comprising:

15 a first pulse width modulator controlling the power
16 switching devices of the first converter circuit;

17 a second pulse width modulator controlling the power
18 switching devices of the second converter circuit;

19 a feedback circuit responsive to the voltage across the
20 common load;

21 control circuits for controlling the first and second pulse
22 width modulators responsive to the feedback circuit;

1 the control circuits also being responsive current
2 measurements through the first converter circuit and the second
3 converter circuit for adjusting the relative duty cycle of the
4 first and second converter circuits;
5 the first pulse width modulator, the second pulse width
6 modulator, the feedback circuit and the control circuits being in
7 a single integrated circuit.
8

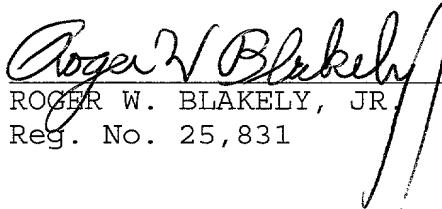
CONCLUSION

In accordance with 37 C.F.R. § 1.173(b), Applicants respectfully submit herewith the proposed amendments for incorporation into the above-identified Reissue application. Reconsideration of pending claims 1-46 is respectfully requested.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: February 8, 2001

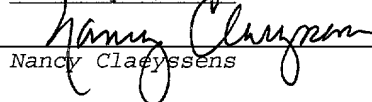


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STATEMENT OF STATUS/SUPPORT FOR CLAIM CHANGES

BOX REISSUE

Assistant Commissioner for Patents
Washington, DC 20231-9998

Sir:

In accordance with 37 C.F.R. SECTION 1.173(c), claims 1-46 are now pending. Support in the disclosure of the patent for newly added claims 22-46 is listed below.

<u>Claim Number</u>	<u>Support in Disclosure</u>
Claim 22	Original claim 1; column 6, lines 21-25 of the printed patent
Claim 23	Original claim 1; column 1, lines 48-49 of the printed patent
Claim 24	Original claim 3

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In light of the foregoing, Applicant respectfully submits that no new substantive matter has been added and respectfully requests consideration of all pending claims.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: February 8, 2001

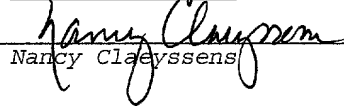


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Nancy Claeysens

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